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January 31, 2020

Ms. Eleni Kavvadias  
U.S. EPA, Region 2 – 25<sup>th</sup> Floor  
290 Broadway  
New York, NY 10007-1866

**Delaware River Screening-Level Ecological Risk Assessment  
Responses to EPA/NJDEP Comments  
Chemours Chambers Works, Deepwater, New Jersey  
NJDEP SRP PI# 008221  
EPA I.D. Number: NJD 002385730**

Dear Ms. Kavvadias:

The attached matrix presents responses to comments received from the U.S. Environmental Protection Agency (EPA) and New Jersey Department of Environmental Protection (NJDEP) on the *Delaware River Screening-Level Ecological Risk Assessment Report* (Delaware River SLERA) that was completed for The Chemours Company (Chemours) Chambers Work facility in Deepwater, New Jersey. The SLERA was submitted to EPA and NJDEP in January 2019 pursuant to the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) and the Technical Requirements for Site Remediation (N.J.A.C. 7:26E). EPA and NJDEP comments were received on October 4, 2019, in a letter dated October 2, 2019. Chemours requested a 60-day extension (to February 1, 2020) to provide written responses to the comments.

Responses to several EPA and NJDEP comments on the Delaware River SLERA address similar comments provided by EPA and NJDEP on the *Salem Canal Screening-Level Ecological Risk Assessment* November 2017. The responses to these comments are congruent with responses previously provided on the Salem Canal SLERA to maintain consistency between ecological risk assessments at the site, as appropriate.

Responses to EPA and NJDEP comments on the Delaware River SLERA are presented in the attached matrix; the text of the comments provided in the EPA and NJDEP letter is presented in the left column and the associated Chemours response is provided in the adjacent column to the right of each comment.

As recommended in the comment letter, Chemours would like to schedule a meeting with EPA and NJDEP to address outstanding risk assessment issues following agency review of the written responses. Chemours anticipates scheduling the technical meeting with the EPA and NJDEP in mid- to late-February 2020, depending on agency availability.

If you have any questions regarding the attached responses or the scheduling of a meeting to review these responses, please email me at [Andrew.S.Hartten@chemours.com](mailto:Andrew.S.Hartten@chemours.com) or call me at 302-773-1289.

Sincerely,

A handwritten signature in black ink, appearing to read "Andrew S. Hartten", written over a horizontal line.

Andrew S. Hartten, P.E.  
Project Director, Chambers Works  
Chemours Corporate Remediation Group

cc: Helen Dudar, NJDEP

**Responses to EPA/NJDEP Comments on the Delaware River Screening-Level Ecological Risk Assessment (October 2, 2019)**  
**Chemours Chambers Works, Route 130**  
**Deepwater, Salem County, New Jersey**  
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USEPA/NJDEP Comment		Chemours Response
USEPA Comments		
1	EPA recommends using the PFAS Ecological Screening Values (To Be Considered Values) sent by Gina Ferreira via email on September 17, 2019.	<p>As stated in the PFAS Ecological Screening Values (To Be Considered) document provided by USEPA by email on September 17, 2019, there are no commonly accepted national or regional ecological screening benchmarks or promulgated ecological standards for PFAS compounds. Ecological screening values that have been proposed for PFAS compounds by state and federal agencies within and outside of the U.S. vary considerably, in some cases by orders of magnitude (Bernhardt et al., 2019). For example, within this comment letter USEPA and NJDEP/ETRA (See NJDEP Comment #4) recommended two different sets of ecological screening criteria for surface water for the Delaware River SLERA. These criteria vary considerably for PFOA and PFOS (by two orders of magnitude for PFOS) :</p> <p><u>PFOA:</u>  USEPA Region 2 (Fish/Aquatic Invertebrates): 2,900 µg/L  Michigan EGLE (formerly DEQ) (Aquatic Life Values): 7,700 µg/L</p> <p><u>PFOS:</u>  USEPA Region 2 (Fish/Aquatic Invertebrates): 5.1 µg/L  Michigan EGLE (formerly DEQ) (Aquatic Maximum Value): 780 µg/L</p> <p>Sediment and surface water data from the Delaware River will be initially compared to the EPA Region 2 Ecological Screening Values (To Be Considered) for screening purposes only. If concentrations exceed the EPA Region 2 Ecological Screening Values (To Be Considered), additional literature-based ecological screening benchmarks and ecotoxicity values that have been proposed for relevant exposure pathways evaluated in the Delaware River SLERA will be compiled to evaluate the variability and uncertainty in ecological screening benchmarks for PFAS compounds. As stated in the USEPA PFAS Ecological Screening Values (To Be Considered) document, it is appropriate to conduct a literature review and discuss applicable research to provide context for the concentrations that are detected, as well as the species and trophic levels that may be exposed. If concentrations exceed the initial EPA Region 2 Ecological Screening Values (To Be Considered), PFAS concentrations in sediment and surface water samples from exposure areas within Delaware River adjacent to Chambers Works will be evaluated relative to the range of ecological screening benchmarks and ecotoxicity values for comparison purposes only.</p>

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USEPA/NJDEP Comment	Chemours Response
<p>2 The report states that, "demersal fish may also be exposed to COPECs through the direct ingestion of sediment-associated prey and the incidental ingestion of sediment and pore water while foraging in sediment." However, these exposure pathways were considered secondary and not quantified. Demersal fish exposure should be evaluated and quantified in this SLERA using conservative food-chain models since sediments within the Delaware River adjacent to the site contain site-related COPECs.</p>	<p>Consistent with the Revised Salem Canal SLERA completed at Chambers Works (EHS Support and AECOM, 2019), the ECSM in the Revised Delaware River SLERA will be updated to include potentially complete pathways for demersal fish, including the direct ingestion of sediment-associated biota and direct contact with bulk sediment and pore water. Dietary exposure to demersal fish will be quantitatively evaluated in the Revised Delaware River SLERA, consistent with the approach used in the Revised Salem Canal SLERA (EHS Support and AECOM, 2019). Further clarification is requested from USEPA or NJDEP on guidance that prescribes the quantitative evaluation of incidental sediment exposure to fish using deterministic dose rate models. Specific clarification is requested regarding the sources of food ingestion rates, incidental sediment ingestion rates, and TRVs derived based on exposure to fish.</p> <p>In the absence of available data to support food-chain modeling of ingestion pathways to demersal fish, dietary exposure to demersal fish will be quantitatively evaluated based on comparisons of estimated dietary concentrations in sediment-associated prey to dietary concentration endpoints [e.g., NOECs or LOECs] from available toxicological databases [e.g., ECOTOX Database] or literature sources, as available. A literature review will be conducted to identify toxicological endpoints to support a quantitative assessment of dietary ingestion pathways to fish. The ECOTOX Database and other available toxicological literature studies will be queried for survival, growth, or reproductive endpoints for fish based on dietary exposure to bioaccumulative COPECs. Consistent with the wildlife ingestion pathway evaluation (see Section 5.2.2), bioaccumulative constituents will be defined as detected organic constituents with log <math>K_{ow}</math> values greater than 3.5 and detected inorganic constituents identified by USEPA as important bioaccumulative constituents (USEPA, 2000a). Selected dietary studies will be based on juvenile and adult life stages that would potentially forage on benthic invertebrates in sediment within the Delaware River adjacent to Chambers Works. Geometric mean concentrations for NOECs and LOECs endpoints for survival, growth, or reproductive endpoints will be calculated for comparison with estimated concentrations in benthic invertebrate dietary items in the Delaware River calculated based on bulk sediment concentrations and BSAFs presented in Appendix B (Wildlife Exposure Modeling Documentation) of the Revised Delaware River SLERA. A summary of the selected dietary studies supporting the calculation of NOEC and LOEC endpoints will be provided in Appendix B of the Revised Delaware River SLERA.</p>

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<p>3 Section 7 of the report describes the Refined Ecological Exposure Evaluation Approach performed after the SLERA was prepared. USEPA agrees with the use of more representative exposure assumptions in the refined evaluation but does not agree with the development and application of ecological benchmarks that include site-specific inputs. The NJDEP Ecological Evaluation Technical Guidance allows for the use of alternative TRVs " based on site-specific circumstances provided that adequate justification is provided." This justification should be presented in the SLERA work plan or technical memorandum for adequate review and research.</p>	<p>As stated in Section 7.0, the conservative assumptions of the preliminary, screening-level evaluation were intended to minimize the potential for excluding a COPEC that may cause an adverse effect. Following the preliminary screening-level evaluation, the refined ecological exposure evaluation was conducted to focus further assessment on those COPECs and exposure pathways that may require additional site-specific investigation. The refinement of COPECs following the screening-level evaluation to focus on COPECs and pathways requiring further assessment is consistent with the re-evaluation procedures prescribed in ERAGS Section 3.2 and supplemental federal guidance documents (USEPA, 2015a; TSERAWG, 2008; USEPA, 2000b; U.S. Navy, 1999).</p> <p>The application of ESBs that include site-specific inputs (e.g., total organic carbon, black carbon) is consistent with the Tier 1 assessment of bulk sediment data provided in the tiered sediment assessment approach presented in NJDEP Ecological Evaluation Technical Guidance for PAHs, as adopted from USEPA (2009); this tiered assessment approach is also appropriate for the assessment of exposure to other non-ionic organic constituents.</p> <p>As prescribed in the tiered assessment approach, the Tier 1 assessment of bulk (whole) sediment data includes the assessment of bioavailability based on comparisons to empirical guidelines [i.e., the comparisons NJDEP ESCs presented in the screening-level evaluation in Section 6.0] or based on EqP based guidelines [i.e., comparisons to calculated ESBs based on station-specific carbon content presented in the refined evaluation presented in Section 7.0]. Documentation of the technical approach for deriving ESBs and detailed ESB calculations were provided for USEPA and NJDEP review in Appendix D of the Delaware River SLERA. If USEPA or NJDEP intends to provide specific comments on the ESB derivation or calculations documented in Appendix D, these comments will be addressed, and any changes incorporated into the Revised Delaware River SLERA.</p> <p>TRVs were selected consistent with the hierarchy prescribed by NJDEP Ecological Evaluation Technical Guidance (NJDEP, 2018). First-tier TRVs presented in NJDEP (2018) were selected for the screening-level exposure evaluation (Section 6.0), as available. For constituents lacking first-tier TRVs in the screening-level evaluation, alternate TRVs were selected from second-tier sources (USEPA, 2005) identified in NJDEP (2018) or widely accepted TRV compilations (Sample et al.,1996). For the refined screening-evaluation, alternate TRVs that are considered protective of chronic exposure were selected only for copper, lead, mercury, LMW PAHs, and HMW PAHs. Alternate TRVs for these COPECs were selected from second-tier sources (USEPA, 2005) identified in NJDEP (2018), widely accepted TRV compilations (Sample et al.,1996), or specific literature studies (Patton and Dieter, 1980). Documentation of the technical approach for TRV selection for the screening-level and refined exposure evaluations was provided in Appendix B of the Delaware River SLERA. If USEPA or NJDEP intends to provide specific comments on the TRV selection procedures documented in Appendix B, these comments will be addressed, and any changes incorporated into the Revised Delaware River SLERA.</p>
<p>4 HQs greater than one indicate that potential ecological risks may be occurring to ecological receptors of concern. There should be no qualifiers on HQs greater than one or emphasis on HQs greater than or less than 10.</p>	<p>The discussion of HQs greater than 10 was not used to exclude COPECs from further evaluation. COPECs with HQs greater than 10 were identified in the discussion of the exposure estimates to indicate those COPECs with the greatest exposure point concentrations relative to the corresponding ecological benchmark concentration. The Revised Delaware River SLERA will be clarified to indicate that these comparisons are for descriptive purposes only and do not have any bearing on the COPEC selection process.</p>

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USEPA/NJDEP Comment	Chemours Response
5 Page 3, Section 1.1 - The third specific objective of the SLERA for each exposure area should be replaced by an objective that includes the use of conservative exposure assumptions and values to calculate screening-level ecological risks. Refining COPECs takes place after the SLERA risks are calculated and show the potential for adverse effects to ecological receptors.	An additional objective will be added to Section 1.1 to indicate the use of conservative exposure assumptions and values to calculate screening-level ecological risks.
6 Page 5, Section 2.1, 1st sentence - Add in the word "acre" after 1455.	The text will be revised to identify Chambers Works as a 1,455-acre site.
7 Page 30, Section 4.7 - Pore water is one item in a weight of evidence approach and is not "afforded greater weight in estimating exposure and characterizing risk to benthic invertebrate communities." As stated to Chemours previously, more effective methods to evaluate exposure are toxicity testing, tissue sampling, and bioaccumulation studies.	<p>As stated in the response to USEPA comments on the Revised Salem Canal SLERA, the statement about affording greater weight to pore water results in the weight-of-evidence evaluation of risk to benthic invertebrates was intended to discuss the relative weight of measurement endpoints. Based on the measurement endpoints evaluated in the Revised Delaware River SLERA, the measurement endpoint based on estimated exposure using and EqP approach is afforded greater weight in estimating exposure to non-ionic organic COPECs relative to bulk sediment comparisons to ESCs because the EqP approach provides an estimate of the freely dissolved concentration of COPECs in pore water, which is a better surrogate than bulk sediment for the bioavailable and toxic fraction (USEPA, 2012a). This statement will be clarified in the Revised Delaware River SLERA.</p> <p>As stated in Section 10.1.2 of the Delaware River SLERA, a tiered approach is recommended to further evaluate benthic invertebrate exposure to non-ionic organic COPECs in sediment consistent with the tiered assessment approach for the assessment of PAHs provided in NJDEP (2018), as adopted from USEPA (2009)<sup>a</sup>. As stated in the response to Comment #3, Tier 1 assessments of non-ionic organic COPEC bioavailability have been preliminarily evaluated in the Delaware River SLERA based on comparisons to ESBs derived in Appendix D. The results of the Tier 1 bioavailability evaluation will provide the basis for the design of the Tier 2 bioavailability assessment that is based on the direct analysis of pore (interstitial) water. The results of the Tier 2 assessment will be used to inform the need for the Tier 3 bioavailability assessment that includes sediment toxicity testing.</p> <p>Bioaccumulation pathways were evaluated in the Delaware River SLERA using BSAFs and receptor exposure parameters based on screening-level and refined exposure scenarios. The findings of the refined exposure evaluation, in addition to the limited bioaccumulation potential of non-ionic COPECs in sediment, indicate that limited exposure and risks to upper trophic wildlife. Therefore, tissue sampling or bioaccumulation studies to evaluate potential bioaccumulation pathways are not warranted based on the assessment of existing data.</p> <p><sup>a</sup> Please note that Delaware River SLERA references Burgess (2009) as the source document for the tiered assessment approach for PAHs, which is the identical document referenced as USEPA (2009d) in the NJDEP Ecological Evaluation Technical Guidance Document.</p>

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USEPA/NJDEP Comment		Chemours Response
8	Page 35, last paragraph - Conservative exposure factors are used in SLERAs to calculate potential ecological risks. Average or typical exposure factors are used in the Baseline Ecological Risk Assessment to calculate risks.	<p>The Delaware River SLERA presented the screening-level exposure evaluation for wildlife based on the RME modeled based on the maximum EPC and a refined exposure evaluation for wildlife based on an average or typical exposure based on the EPC UCLmean. Both exposure scenarios were modeled based on average or typical receptor exposure factors.</p> <p>The uncertainty analysis presented in the Revised Delaware River SLERA will be revised to include an evaluation of the sensitivity of exposure factors in the identification of COPECs in the screening-level exposure evaluation for wildlife. The sensitivity analysis will evaluate the potential RME scenario based on more conservative (upper bound) receptor exposure factors. Any COPECs with modeled doses resulting in HQs &gt; 1 based on upper bound exposure factors that did not result in HQs &gt; 1 based on average exposure factors will be identified and discussed in the uncertainty analysis.</p>
9	Page 48, Section 7.2.3 - This section states that surficial sediment samples from the depth 0 to 2 centimeters from the DIVER database were used to estimate representative background concentrations. This depth which equals less than 1 inch (0.79) is not representative of the site sediment found at depths of 0 - 6 inches and 6 inches to 1 foot.	<p>The NOAA DIVER dataset was used in the Delaware River SLERA to calculate representative background sediment concentrations. This dataset represents an updated and more comprehensive regional dataset than the U.S. Army Corps of Engineers Delaware River Main Channel Deepening Project dataset used previously to estimate regional background sediment concentrations in the Delaware River Remedial Investigation Report (URS, 2011).</p> <p>DIVER sediment data from the 0 to 2-cm sampling interval were used to maximize the spatial extent of the available surficial data in the dataset. It is acknowledged that this surficial interval is shallower than the intervals sampled within the exposure areas adjacent to Chambers Works and likely represents more recently deposited sediment. However, background sediment concentrations calculated using this shallow surficial interval provide a more conservative estimate of regional or background concentrations given the overall reduction of contaminant loading the Delaware River over time. Including deeper sampling intervals from regional sampling stations (0-0.5-ft or 0.5-1-ft), if available, would likely increase the BTVs calculated from the surficial DIVER data, thereby resulting in a less conservative refinement of COPECs based on comparisons to background for the exposure areas evaluated in the Delaware River SLERA.</p>
<b>NJDEP Comments</b>		
1	Executive Summary, page xi, Manufacturing Zone and page xii, Carneys Point Zone: The Report states that sediments that "adversely affect benthic communities" are "spatially-limited." Considering that benthos do not have a large range of movement, even "spatially-limited" areas must be addressed.	Section 10.1.2, of the Delaware River SLERA recommends further evaluation of the potential for adverse effects to benthic invertebrate receptors in the spatially-limited areas identified in the Fluoroproducts and Jackson Labs/TEL Areas. As stated in the response to USEPA Comment #7, a tiered approach is recommended to further evaluate benthic invertebrate exposure to non-ionic organic COPECs in sediment consistent with the tiered assessment approach for the assessment of PAHs provided in NJDEP (2018), as adopted from USEPA (2009).
2	The Report emphasizes the use of equilibrium partitioning (EqP). In accordance with NJDEP 2018, Section 6.2.2.3, EqP is only one line of evidence and collection of pore water samples is preferred.	Please refer to the response to USEPA Comment #7. A tiered approach is recommended to further evaluate benthic invertebrate exposure to non-ionic organic COPECs in sediment consistent with the tiered assessment approach for the assessment of PAHs provided in NJDEP (2018), as adopted from USEPA (2009).
3	The SLERA minimizes any HQ less than 10. This is counter to all guidance, both USEPA and NJDEP. Any HQ above 1 must be carried through to the baseline ecological risk assessment (BERA).	Please refer to the response to USEPA Comment #4.

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USEPA/NJDEP Comment	Chemours Response
<p>4 1.0 Introduction, page 2: The SLERA states that samples from the Salem canal and Delaware River "were analyzed for perfluorinated compounds ... [; however,] ... [t]hese results are not included in the ecological exposure evaluations presented in the SLERA due to the lack of reliable ecotoxicity data for these constituents." NJDEP/ETRA encourages the use of the Michigan "Aquatic Maximum Values" of 7,700 µg/L for PFOA (CAS # 335671) and 780 µg/L for PFOS (CAS # 1763231) (<a href="https://www.michigan.gov/documents/deq/wrd-swas-rule57_372470_7.pdf">https://www.michigan.gov/documents/deq/wrd-swas-rule57_372470_7.pdf</a>).</p>	<p>Please refer to the response to USEPA Comment #1.</p>
<p>5 1.1 Scope and Objectives, page 3: The third bullet in this section states "refine the list of COPECs using exposure assumptions that are more representative of site-specific exposure conditions." This step is associated with the BERA and should not be part of the SLERA.</p>	<p>Please refer to the response to USEPA Comment #5 regarding the revision of objectives to indicate the use of conservative exposure assumptions and values to calculate screening-level ecological risks.</p> <p>Please refer to the response to USEPA Comment #3 regarding the use of the refined ecological exposure evaluation to focus further assessment on those COPECs and exposure pathways that may require additional site-specific investigation.</p>
<p>6 4.5.1 Bioaccumulation, page 26: The first paragraph on this page list sources for chemical properties. Where available, the USEPA Regional Screening Tables should be used for chemical properties (<a href="https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables">https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables</a>).</p>	<p>K<sub>ow</sub> values uses to evaluate COPEC bioaccumulation potential (Section 4.5.1) and for the calculation of K<sub>oc</sub> in the derivation of ESBs (Appendix D) were obtained from the USEPA KOWWIN v. 1.68 application within the EPI Suite software package (USEPA, 2012b).</p> <p>Given that chemical properties, including K<sub>ow</sub> and K<sub>oc</sub> values, may be obtained from multiple USEPA sources, an evaluation of the differences in chemical properties obtained from the Delaware River SLERA from USEPA KOWWIN v. 1.68 and USEPA Regional Screening Tables will be added to the Uncertainty Analysis. The uncertainty evaluation will discuss how any potential differences between sources may affect the calculations or findings presented in the SLERA.</p>
<p>7 4.5.2 Ecotoxicity, Volatile and Semi-Volatile Organic Constituents, pp 27-28: The SLERA references "acute toxicity data for chlorobenzene." Chronic ecotoxicity values must be used in the SLERA.</p> <p>The SLERA references EPA guidance for PAH evaluation. The tiered approach as outlined in NJDEP 2018, Section 6.4.6 should be used.</p>	<p>The acute toxicity value for chlorobenzene referenced in Section 4.5.2 was intended as a point of reference in the general review of ecotoxicity data for class of constituents identified in site media. Only chronic ecotoxicity values were used in the calculations of screening-level and refined exposure estimates presented in the Delaware River SLERA.</p> <p>As indicated in the response to USEPA Comment #7, the Delaware River SLERA recommends that the tiered sediment assessment approach presented in NJDEP (2018), as adopted from USEPA (2009) be followed for the evaluation of PAHs and other non-ionic organic COPECs. Please note that Delaware River SLERA references Burgess (2009) as the source document for the tiered assessment approach for PAHs, which is the identical document referenced as USEPA (2009d) in the NJDEP Ecological Evaluation Technical Guidance Document.</p>

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USEPA/NJDEP Comment	Chemours Response
<p>8 4.6.1 Benthic Invertebrates, page 29: The SLERA relies almost exclusively on the equilibrium partitioning (EqP) to make toxicity determinations. In accordance with NJDEP 2018, Section 6.2.2.3, EqP is only one line of evidence, and the collection and analysis of pore water samples is preferred. Therefore, this section of the SLERA should be rewritten to deemphasize EqP.</p>	<p>Please refer to the response to USEPA Comment #7. Based on the measurement endpoints evaluated in the Delaware River SLERA, the measurement endpoint based on estimated exposure using and EqP approach is afforded greater weight in estimating exposure to non-ionic organic COPECs relative to bulk sediment comparisons to ESCs because the EqP approach provides an estimate of the freely dissolved concentration of COPECs in pore water, which is a better surrogate than bulk sediment for the bioavailable and toxic fraction (USEPA, 2012a). Therefore, the emphasis on the EqP results is appropriately prioritized in the Delaware River SLERA.</p> <p>As stated in the response to EPA Comment #7, the collection of pore water samples is recommended within the framework of the tiered assessment approach for the assessment of PAHs provided in NJDEP (2018), as adopted from USEPA (2009)<sup>a</sup> a tiered approach is recommended to further evaluate benthic invertebrate exposure to non-ionic organic COPECs in sediment consistent with the tiered assessment approach for the assessment of PAHs provided in NJDEP (2018), as adopted from USEPA (2009)<sup>a</sup>. The results of the Tier 1 bioavailability evaluation based on EqP will provide the basis for the design of the Tier 2 bioavailability assessment that is based on the direct analysis of pore (interstitial) water.</p> <p><sup>a</sup> Please note that Delaware River SLERA references Burgess (2009) as the source document for the tiered assessment approach for PAHs, which is the identical document referenced as USEPA (2009d) in the NJDEP Ecological Evaluation Technical Guidance Document.</p>
<p>9 4.7 Assessment and Measurement Endpoints, page 30: The SLERA states that "the measurement endpoint based on estimated exposure to pore water using an EqP approach is afforded greater weight in estimating exposure and characterizing risk to benthic invertebrate communities." See 4.6.1 Benthic Invertebrates, above.</p>	<p>Please refer to the response to USEPA Comment #7 and NJDEP Comment #8.</p>
<p>10 4.8.1 Sediment, page 31: The SLERA references "calculated ESVs based on an EqP model (DuPont CRG, 1999)." These values and their derivation should be provided for review.</p>	<p>The technical basis for the EqP-based calculation of the ESVs for aniline will be included in Appendix D of the Revised Delaware River SLERA.</p>
<p>11 5.1.1 Bulk Sediment, page 32: The SLERA states that the biotic zone "extends from the SWI to a maximum depth of 0.5 feet below the SWI." In accordance with NJDEP 2018, Section 4.0, the biotic zone for sediment is generally 0"-6"; however, may extend deeper based on the presence of burrowing receptors.</p>	<p>The BAZ was operationally defined in the Delaware River SLERA as the sediment interval extending from the SWI to 0.5-feet (0 to 6-inches) below the SWI. While burrowing receptors may extend to depths deeper than the operational depth of the BAZ, USEPA (2015b) identifies the zone of greatest organism-substrate interaction (defined as the depth from the SWI containing the 80th percentile of benthic invertebrate abundance and the 80th percentile of benthic invertebrate abundance biomass) in Tidal Freshwater Mixed Substrate habitat types similar to the Delaware River adjacent to Chambers Works is between 4 to 6-inches (10 to 15-cm as reported in Table 5 of USEPA, 2015b). Therefore, the 0 to 6-inch sediment exposure interval evaluated in the Delaware River SLERA is protective of the zone of greatest organism-substrate interaction that USEPA (2015b) has identified as the biologically relevant sediment depths for decisions related to ecological assessment or remediation. Addition detail regarding the selection of the biologically relevant sampling depth for exposure areas within the Delaware River will be provided in the Revised Delaware River SLERA.</p>



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USEPA/NJDEP Comment	Chemours Response
<p>12 5.1.2 Surface Water, page 33: The SLERA states that "surface water samples were collected at approximately 1 foot above the SWI or at mid-water interval for stations with a total water depth less than 3 feet." In accordance with NJDEP 2018, Section 5.3.3.2, "when COPECs are potentially present because of sediment contamination or groundwater migration pathway, samples should be collected from the zero to six-inch interval directly above the sediments."</p>	<p>As presented in Table 4 of the Delaware River SLERA, surface water data included in the risk assessment were collected between 2009 and 2010 as part of the phased Remedial Investigation, except for limited sampling conducted within the Tidal Reach of the Salem Canal in 2016. Therefore, the majority of the surface water samples used to estimate exposure along the shoreline were collected prior to the issuance of the first version of the NJDEP Ecological Evaluation Technical Guidance in 2015. However, further evaluation of surface water concentrations immediately above the sediment-surface water interface may be incorporated into Tier 2 investigations of benthic invertebrate exposure in areas identified for further assessment, as described in the response to USEPA Comment #7.</p>
<p>13 5.2.2 Wildlife Ingestion Pathway Evaluation, pages 34-36: The SLERA states that the "models estimated EDDs within each of the four exposure areas ... and summed the spatially weighted EDDs ... to evaluate aggregate exposure along the entire Chambers Works shoreline." No "clean zone" samples should be included in the evaluation for the SLERA. Either each contaminant area should be evaluated separately, or only the values with each contaminated area should be summed.</p> <p>The SLERA states that "for constituents with EDDs exceeding first-tier TRVs in the screening-level exposure evaluation, alternative TRVs were considered in the refined exposure evaluation (Section 7.3.3)." The NOAEL and LOAEL form the TRVs selected from the tier 1 group are to be used to bound the risk throughout the ecological risk assessment process. The reason for including tier 2 and tier 3 TRVs in NJDEP 2018 is so that if a site has contaminants that are not included in the tier 1 TRVs, then TRVs from tier 2 can be selected. Likewise, if the site has contaminants that neither tier 1 nor tier 2 TRVs are available, then TRVs can be selected from the tier 3 group (literature search). Adequate justification must be provided to vary from these TRVs. Therefore, the tier 1 TRVs should be carried throughout the risk assessment. In the BERA, the numerator of the risk calculation may be modified using of area use factors and seasonal use factors; however, the TRVs remain the</p>	<p>The screening-level exposure evaluation for wildlife conservatively assumed that representative receptors forage 100 percent of the time (AUF = 1) at the maximum exposure point concentration within each individual exposure area evaluated adjacent to Chambers Works. For the refined exposure evaluation, exposure to representative wildlife receptors foraging along the Delaware River shoreline immediately adjacent to Chambers Works was estimated at UCLmean concentrations calculated from data within each individual exposure area. The dose estimated for each receptor within an individual exposure area was adjusted by an AUF to reflect the time a receptor was likely to forage in a given exposure area. AUFs were estimated based on the ratio of the individual exposure area size to the total size of the receptor home range. The total dose obtained along the Chambers Works shoreline was calculated as the sum of the AUF-adjusted doses calculated for each of the four exposure areas. The text and Appendix B of the Delaware River SLERA will be clarified to address confusion in the estimation of wildlife exposure in the screening-level and refined exposure evaluations.</p> <p>As stated in the response to USEPA Comment #3, TRVs were selected consistent with the hierarchy prescribed by NJDEP Ecological Evaluation Technical Guidance (NJDEP, 2018). First-tier TRVs presented in NJDEP (2018) were selected for the screening-level exposure evaluation (Section 6.0), as available. For constituents lacking first-tier TRVs in the screening-level evaluation, alternate TRVs were selected from second-tier sources (USEPA, 2005) identified in NJDEP (2018) or widely accepted TRV compilations (Sample et al., 1996).</p> <p>For the refined screening-evaluation, alternate TRVs that are considered protective of chronic exposure were selected only for copper, lead, mercury, LMW PAHs, and HMW PAHs. Alternate TRVs for these COPECs were selected from second-tier sources (USEPA, 2005) identified in NJDEP (2018), widely accepted TRV compilations (Sample et al., 1996), or specific literature studies for PAHs (USEPA, 2007; Patton and Dieter, 1980). The TRVs used in the refined exposure evaluation are considered protective of chronic exposure and, with the exception of the literature studies, have been used for screening-purposes. Documentation of the technical approach for TRV selection for the screening-level and refined exposure evaluations was provided in Appendix B of the Delaware River SLERA. However, further documentation of the protectiveness of the alternate TRVs used in the refined exposure evaluation for copper, lead, mercury, LMW PAHs, and HMW PAHs will be presented in the Revised Delaware River SLERA.</p>

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<p>14 6.2.1 Jackson Labs/TEL Area, Benthic Invertebrates, pages 338-39: The SLERA uses the term "preliminary ESVs." There are no preliminary ESVs. Ecological screening criteria (ESCs) or ecological screening values (ESVs) are used to determine which contaminants will be carried through for further evaluation. At that point, the risk assessment process begins.</p> <p>The SLERA uses ranges of HQs and dismisses any HQs less than 10. This is unacceptable. All contaminants with an HQ greater than 1 must be carried through to the risk assessment process.</p> <p>The SLERA dismisses acetone as a laboratory contaminant without providing any evidence. This is unacceptable. DuPont must provide data from trip blanks, method blanks, etc. with elevated acetone levels in order to make the claim that it is a laboratory contaminant.</p>	<p>The screening-level exposure estimates used NJDEP ESCs or comparable screening criteria in the absence of NJDEP ESCs. Constituents with maximum concentrations exceeding ESCs or equivalent screening criteria were carried through to the refined exposure evaluation. Further assessment in the refined exposure evaluation was based on alternate chronic sediment quality benchmarks derived using the ESB approach prescribed in USEPA guidance for PAHs and other non-ionic organic COPECs or alternate chronic criteria for metals and PCBs. As stated in the response to USEPA Comment #3, the refinement of COPECs following the screening-level evaluation to focus on COPECs and pathways requiring further assessment is consistent with the re-evaluation procedures prescribed in ERAGS Section 3.2 and supplemental federal guidance documents (USEPA, 2015; TSERAWG, 2008; USEPA, 2000; U.S. Navy, 1999).</p> <p>As stated in the response to USEPA Comment #4, the discussion of HQs greater than 10 was not used to exclude COPECs from further evaluation. COPECs with HQs greater than 1 were carried through to the refined exposure evaluation. HQs greater than 10 were identified in the discussion of the screening-level exposure estimates to indicate those COPECs with the greatest exposure point concentrations relative to the corresponding ecological benchmark concentration. The Revised Delaware River SLERA will be clarified to indicate that these comparisons are for descriptive purposes only and do not have any bearing on the COPEC selection process.</p> <p>Further evaluation of the potential source of acetone will be presented in the Revised Delaware River SLERA, including an evaluation of associated quality assurance/quality control samples that may indicate laboratory contamination.</p>
<p>15 Fish, page 39: See comment above regarding HQs above 1.</p> <p>The SLERA ignored the sediment and food pathways for fish exposure. This is unacceptable and the risk assessment must include these pathways.</p>	<p>Please refer to the response to USEPA Comment #2. Consistent with the Revised Salem Canal SLERA completed at Chambers Works (EHS Support and AECOM, 2019), the ECSM in the Revised Delaware River SLERA will be updated to include potentially complete pathways for demersal fish, including the direct ingestion of sediment-associated biota and direct contact with bulk sediment and pore water. In the absence of available data to support dose rate modeling of ingestion pathways to demersal fish, dietary exposure to demersal fish will be quantitatively evaluated in the Revised Delaware River SLERA, consistent to the approach used in the Revised Salem Canal SLERA (EHS Support and AECOM, 2019).</p>
<p>15* 6.2.2 - 6.2.5, pages 40-45: The comments from 6.2.1, above, apply to these sections.</p>	<p>Comment noted. Relevant comments pertaining to Section 6.2.1 will be applied to the screening-level exposure estimate sections for other exposure areas.</p> <p>* Please note that two comments were listed as Comment #15 in the NJDEP comment section.</p>
<p>16 6.3.1 Benthic Invertebrates, page 45: The SLERA uses "site-specific ESVs." See comments in 6.2.1, above.</p>	<p>Please refer to the response to NJDEP Comment #14.</p>

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<p>17 6.3.2 Fish, page 45: The food chain and sediment pathways must be evaluated for fish.</p> <p>The SLERA states that "the estimate bioaccumulation of other persistent bioaccumulative constituents, including pesticides and PCBs, into benthic invertebrates and fish did not result in doses that are expected to cause adverse effects;" however, these levels were not measured in the field and no bioaccumulation tests were conducted with the sediment in a laboratory.</p> <p>The SLERA states that "incidental ingestion of sediment... was not quantitatively evaluated in the SLERA." This pathway must be evaluated and generally a value of 5%-10% of the food ingestion rate is used, dependent on the foraging methods employed by the receptor being evaluated.</p> <p>The SLERA concludes "no further evaluation." This is unacceptable. All comments must be addressed.</p>	<p>Please refer to the response to NJDEP Comment #15 and USEPA Comment #2 regarding the assessment of dietary exposure to fish.</p> <p>As indicated in the response to Comment #2, further clarification is requested from USEPA or NJDEP on guidance that prescribes the quantitative evaluation of incidental sediment exposure to fish using deterministic dose rate models. Specific clarification is requested regarding the sources of food ingestion rates, incidental sediment ingestion rates, and TRVs derived based on exposure to fish.</p> <p>As indicated in the comment, SLERA conclusions regarding exposure to fish will be revisited following the resolution of NJDEP and USEPA comments.</p>
<p>18 6.3.3 Semi-Aquatic Wildlife, page 46: Tissue measurement will reduce the uncertainty in this section.</p>	<p>It is acknowledged that site-specific tissue measurement reduces the uncertainty associated with the estimation of tissue concentrations based on bioaccumulation modeling from bulk sediment using a BSAF. However, the use of BSAFs are included NJDEP Ecological Evaluation Technical Guidance (Section 6.1.3.2) and standard ecological risk assessment practices as an initial estimate of potential bioaccumulation pathways.</p> <p>As stated in the response to USEPA Comment #3, the findings of the refined exposure evaluation, in addition to the limited bioaccumulation potential of non-ionic COPECs in sediment, indicate that limited exposure and risks to upper trophic wildlife. Therefore, tissue sampling or bioaccumulation studies to evaluate potential bioaccumulation pathways are not warranted based on the assessment of existing data.</p>
<p>19 See previous comments regarding TRVs.</p>	<p>Comment noted. Please refer to the response to NJDEP Comment #13.</p>
<p>20 7.0 Refined Ecological Exposure Evaluation Approach, page 47: The SLERA uses "frequency and magnitude of detection" to eliminate COPECs. Hot spots must be considered before frequency and magnitude of detection may be considered.</p>	<p>The refined ecological exposure evaluation in the Revised Delaware River SLERA will include an evaluation of localized areas as potential hot spots in accordance with Section 6.4.4 of the NJDEP Ecological Evaluation Technical Guidance (NJDEP, 2018). This evaluation will be conducted prior to the consideration of the frequency and magnitude of detection for the exclusion of COPECs in the refined exposure evaluation.</p>

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21	7.2.1 Exposure Point Concentrations, pages 47-48: The SLERA uses statistics to eliminate COPECs. In the calculations of the UCL, clean zone samples should not be included in the calculations and hot spots must be considered.	As stated in the response to NJDEP Comment #20, an evaluation of localized areas as potential hot spots in accordance with Section 6.4.4 of the NJDEP Ecological Evaluation Technical Guidance will be conducted as part of the refined exposure evaluation. Exposure point concentrations calculated based on UCLmean concentrations will not include COPEC concentrations at stations that may be indicative of a hot spot based on the criteria presented in the NJDEP Ecological Evaluation Technical Guidance.
22	7.2.3 Comparison to Background Threshold Values, page 48: The SLERA uses regional data for background. USEPA questioned the appropriateness of the data used. In addition, The following must be considered when using regional data: 1) data associated with other potential sources must be excluded in accordance with the "background contamination" definition in Section 4.0 of NJDEP 2018; 2) outliers within the dataset must be removed in accordance with Section 5.4.3 of NJDEP 2018; 3) UTL, UPT or UCL values cannot exceed the maximum value in the dataset; and, 4) like statistics from the site and regional or background datasets must be compared in accordance with Section 5.4.3 of NJDEP 2018. The data should be supplied for separate analysis.	<p>Please see the response to USEPA Comment #9 regarding the use of surficial sediment data from the NOAA DIVER database for the calculation of background threshold values.</p> <p>As discussed in Section 7.2.3, the approach for calculating BTVs using regional NOAA DIVER sediment data was consistent with the guidance provided in NJDEP Ecological Evaluation Technical Guidance. Considerations identified in the NJDEP comment were addressed as follows:</p> <p>1) Site influence and background contamination: The background dataset included available surficial sediment data from Zone 5 of the Delaware River, excluding sediment samples collected within the section of Zone 5 adjacent to Chambers Works. Sediment sampling points from the Delaware Memorial Bridge north to Carneys Point were excluded from the background assessment to minimize the potential influence of the site. Figure 21 illustrates the locations of NOAA DIVER background stations included in the BTV calculations.</p> <p>2) Outliers: Background datasets were tested for potential statistical outliers using the Dixon outlier test included in USEPA ProUCL v. 5.1 software for all constituents, except total PCBs (congeners); outlier testing for total PCBs (congeners) was based on Rosner's test in ProUCL due to its sample size exceeding 25. Identified outliers were removed from the background dataset prior to the calculation of BTVs. The text in Section 7.2.3 of the SLERA will be revised to specify the outlier procedures that were used and the ProUCL output will be made available to USEPA and NJDEP, if requested.</p> <p>3) BTVs exceeding the maximum background value: As illustrated in Table 19 of the Delaware River SLERA, recommended BTVs were below the maximum background dataset for all constituents, except aluminum, nickel, and zinc. However, maximum concentrations of these constituents were below the UTL for the background dataset, which may be used as the basis for BTVs.</p> <p>4) Comparison of like statistics: In the refined exposure evaluation, maximum EPCs within an exposure area were compared to BTVs representing the upper bound of the background dataset from the DIVER database. COPECs with maximum EPCs below the BTVs were considered to be within the range of regional background concentrations and were not evaluated further in the SLERA (i.e., concentrations of all individual samples were below the BTV within a given exposure area).</p> <p>The Revised Delaware River SLERA will include a summary of the NOAA DIVER database as appendix to facilitate separate analyses by NJDEP, as warranted.</p>

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23 7.2.4 Refined Bulk Sediment Quality Benchmarks, pages 49-50: See previous comments on EqP. The SLERA states that the "ΣESBTU values less than 1 are considered to be protective of benthic invertebrate communities." Toxicity tests are preferred.	<p>Please see the response to USEPA Comment #7, the Delaware River SLERA recommends that the tiered sediment assessment approach presented in NJDEP (2018), as adopted from USEPA (2009)<sup>a</sup> be followed for the evaluation of PAHs and other non-ionic organic COPECs. Tier 1 assessments of non-ionic organic COPEC bioavailability have been preliminarily evaluated in the Delaware River SLERA based on comparisons to ESBs derived in Appendix D. The results of the Tier 1 bioavailability evaluation will provide the basis for the design of the Tier 2 bioavailability assessment that is based on the direct analysis of pore (interstitial) water. The results of the Tier 2 assessment will be used to inform the need for the Tier 3 bioavailability assessment that includes sediment toxicity testing.</p> <p><sup>a</sup> Please note that Delaware River SLERA references Burgess (2009) as the source document for the tiered assessment approach for PAHs, which is the identical document referenced as USEPA (2009d) in the NJDEP Ecological Evaluation Technical Guidance Document.</p>
24 PAHs, page 52: The SLERA states that chemical properties were obtained from EPA, 2012a and EPA 2003a. Chemical property data should be obtained from the RSL ( <a href="https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables">https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables</a> ) for the most up to date chemical properties, where available.	Please see the response to NJDEP Comment #6. Given that chemical properties, including $K_{ow}$ and $K_{oc}$ values, may be obtained from multiple USEPA sources, an evaluation of the differences in chemical properties obtained from sources presented in the Delaware River SLERA and USEPA Regional Screening Tables will be added to the Uncertainty Analysis. The uncertainty evaluation will discuss how any potential differences between sources may affect the calculations or findings presented in the SLERA.
25 7.3.3 Toxicity Reference Values, pages 53-54: See previous comments regarding TRVs.	Comment noted. Please refer to the response to NJDEP Comment #13.
26 8.1.2 Semi-Aquatic Wildlife, pages 59-60: See previous comments regarding TRVs. The most conservative TRVs should be used to be protective of the most sensitive receptors; the exposure factors may be adjusted.	Comment noted. Please refer to the response to NJDEP Comment #13.
27 8.2.1 Benthic Invertebrates, page 60: The SLERA states that the contaminated areas consist of "spatially limited areas." Considering that benthos have a very limited home range, even spatially limited areas can have an effect on them.	Section 10.1.2, of the Delaware River SLERA recommends further evaluation of the potential for adverse effects to benthic invertebrate receptors in the spatially-limited areas identified in the Fluoroproducts and Jackson Labs/TEL Areas. As stated in the response to USEPA Comment #7, a tiered approach is recommended to further evaluate benthic invertebrate exposure to non-ionic organic COPECs in sediment consistent with the tiered assessment approach for the assessment of PAHs provided in NJDEP (2018), as adopted from USEPA (2009).
28 8.2.2 Semi-Aquatic Wildlife, page 61: The SLERA states that "negligible site-related risk to semi-aquatic wildlife" is indicated. All previous comments must be addressed.	Comment noted. The findings of the refined risk characterization for semi-aquatic wildlife presented in Section 8.2.2 will be revisited following the resolution of USEPA and NJDEP comments.

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<p>29 8.3 Scientific Management Decision Point, pages 61-62: The SLERA reiterates that "negligible site-related risk to semi-aquatic wildlife" is indicated. All previous comments must be addressed.</p> <p>The SLERA indicates negligible risk to fish; however, sediment and food chain exposure were ignored. See previous comments.</p> <p>The SLERA indicates that a more thorough evaluation of benthos needs to be conducted. NJDEP agrees; however, all previous comments must be addressed, and the further evaluation must be conducted in accordance with regulations and guidance.</p>	<p>Comment noted. The SMDP for the primary ecological receptor groups will be revisited following the resolution of USEPA and NJDEP comments.</p>
<p>30 9.1.1 Screening and Sediment Quality Benchmarks, page 63: All previous comments must be addressed.</p>	<p>Comment noted. The discussion of uncertainty with sediment quality benchmarks presented in Section 9.1.1 will be revisited following the resolution of USEPA and NJDEP comments.</p>
<p>31 9.1.2 Constituent Bioavailability, page 64: The SLERA indicates that differences in absorption could over or under estimate bioavailability. Tissue sampling or laboratory bioaccumulation tests can eliminate this uncertainty.</p>	<p>Comment noted. Please refer to the response to NJDEP Comment #18.</p>
<p>32 10.0 Conclusions and Recommendations - 10.2.2 Recommendations, pages 66-69: All previous comments must be addressed.</p>	<p>Comment noted. Please refer to the response to NJDEP Comment #18.</p>

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Notes:

% = percent  
 $\Sigma$ ESBTU = Sum of Equilibrium Partitioning Sediment Benchmark Toxic Units  
 $\mu\text{g/L}$  = micrograms per liter  
AUF = area use factor  
BAZ = biologically active zone  
BERA = baseline ecological risk assessment  
BSAF = biota-sediment accumulation factor  
BTV = background threshold value  
cm = centimeter  
COPEC = contaminant of potential environmental concern  
DIVER = Data Integration Visualization Exploration and Reporting  
ECOTOX = ECOTOXicology Database  
ECSM = ecological conceptual site model  
EDD = Estimated daily dose  
EGLE = Michigan Department of Environment, Great Lakes, and Energy  
EPC = exposure point concentration  
EqP = equilibrium partitioning  
ERAGS = Ecological Risk Assessment Guidance for Superfund  
ESB = equilibrium partitioning sediment benchmark  
ESC = Ecological screening criteria  
ESV = ecological screening value  
ETRA = Environmental Toxicology and Risk Assessment  
HMW = high molecular weight  
HQ = hazard quotient  
 $K_{OC}$  = organic carbon partitioning coefficients  
 $K_{OW}$  = octanol-water partitioning coefficient

LMW = low molecular weight  
LOEC = low observed effect concentration  
LOAEL = lowest observed adverse effect level  
Michigan EGLE = Michigan Environment, Great Lakes & Energy  
NJDEP = New Jersey Department of Environmental Protection  
NOAA = National Oceanic and Atmospheric Administration  
NOEC = no observed effect concentration  
NOAEL = no observed adverse effect level  
PAH = polycyclic aromatic hydrocarbon  
PCB = polychlorinated biphenyl  
PFAS = per- and polyfluoroalkyl substances  
PFOA = perfluorooctanoic acid  
PFOS = perfluorooctanesulfonic acid  
RME = reasonable maximum exposure  
RSL = regional screening level  
SLERA = screening level ecological risk assessment  
SMDP = scientific management decision points  
SWI = surface water-sediment interface  
TEL = Threshold effects level  
TRV = toxicity reference value  
TSERAWG = Tri-Services Environmental Risk Working Group  
U.S. = United States  
 $UCL_{MEAN}$  = Upper Confidence Limit Mean  
USEPA = United States Environmental Protection Agency  
UTL = upper tolerance limit

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